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not yet evolved the chemist and banker, but such an evolution, or at least the close alliance of chemistry and banking is a fundamental prerequisite if the results of industrial research are to find their full fruition in America. Let me add that no field within the purview of the banker is more ripe for tillage or capable of yielding a richer harvest.

We need, however, to lead the banker to the chemical point of view, and even more do we ourselves require to be taught the financial principles involved in the broad application of chemistry to industry. To the ideals of service which inspire our profession, and which are so finely exemplified in Cottrell and made effective in the research corporation, we should add a stronger impulse to direct personal initiative in affairs. We shall need for years to prosecute a vigorous campaign for a better understanding by the general public of what chemistry is and what research is. The popular imagination is ready to accept any marvel which claims the laboratory as its birthplace, but the man in the works still disbelieves that two and two in chemical nomenclature make four. We need a multiplication of research laboratories in special industries, each with an adequate staff of the best men obtainable and an equipment which gives full range to their abilities. In nearly every case this equipment should include apparatus of semi-commercial size in which to reduce to practise the laboratory findings. Nothing is more demoralizing to an industrial organization, and few things are more expensive, than full-scale experimentation in the plant.

These laboratories should each be developed around a special library, the business of which should be to collect, compile and classify in a way to make all instantly available, every scrap of information bearing upon the materials, methods, products and requirements of the industry concerned. Modern progress can no longer depend upon accidental discoveries. Each advance in industrial science must be studied, organized and fought like a military campaign. Or, to change the figure, in the early days of our science, chemists patrolled the shores of the great ocean of the unknown, and seizing upon such fragments of truth as drifted within their reach, turned them to the enrichment of the intellectual and material life of the community. Later they ventured timidly to launch the frail and often leaky canoe of hypothesis and returned with richer treasures. To-day, confident and resourceful, as the result of many argosies, and having learned to read the stars, organized, equipped, they set sail boldly on a charted sea in staunch ships with tiering canvas bound for new El Dorados.

Arthur D. Little

SOME PALEONTOLOGICAL RESULTS OF THE SWEDISH SOUTH POLAR EXPEDITION UNDER NORDENSKIOLD

Since the days of Sir Joseph Hooker's article[1] on southern pines which was published in 1845 there has been much speculation regarding Antarctica as a center of evolution and radiation of both floras and faunas and as affording a theater for the interchange of floras and faunas between South America, Africa and Australia.[2] Outside of the deductions based on the geographical distribution of the existing biota of these three regions practically no facts have been available from Antarctica itself, particularly regarding the extinct forms of this great ice-covered land-mass.

Antarctic exploration has been very active during the past decade and popular as well as scientific interest has been greatly heightened

[1] *Jour. Bot.*, Vol. 4, 1845, p. 137.

[2] See recent summary by Hedley in *Proc. Linn. Soc. Lond.*, reprinted in Smithsonian Report for 1912, pp. 443–453, 1913.

of late by Captain Amundsen's discovery of the South Pole and by the tragic fate of Captain Scott and his little band of heroes after they too had penetrated to the pole. It has, therefore, seemed worth while to bring together a brief account of the recently described paleontological discoveries, naturally laying particular emphasis on those of a paleobotanical nature.

The hardship under which Gunnar Andersson collected the splendid Mesozoic flora of Graham Land and the bag of geological specimens which Scott's party dragged along to their last camp bear eloquent testimony to a devotion not only to the ideal of science, but also to that of manhood that should be an inspiration alike to scientist and to layman.

Ten years ago not a single fossil plant was known from the 14½ million square miles of the earth's surface south of latitude 60° which roughly marks the boundary of the Antarctic continent, in fact it was not certainly known that Antarctica was really a continent and not merely an archipelago.

The paleobotanical results to be noted presently are due almost entirely to the expedition led by Dr. Otto Nordenskiöld,[3] nephew of the discoverer of the Northeast passage, and to Captain Larsen of his ship the *Antarctic*. They reached the South Shetlands in January, 1902, and the party spent two winters on Snow Hill Island, 64° 25′ S. Petrified wood and Cretaceous and Tertiary plants were collected on Seymour and Snow Hill Islands while J. Gunnar Andersson who with Lieutenant Duse was forced to pass an unprepared-for winter at Hope Bay, collected the fine series of Jurassic plants that form the basis for Halle's memoir to be discussed presently.

Captain Larsen[4] during his voyages with the *Jason* in 1892–1894 had found fossil mollusca and petrified wood on Seymour Island, as had also the English expedition, and this was one of the principal factors in deciding upon the itinerary of Nordenskiöld's expedition. The results more than justified the expectations of the explorers, for in addition to the collection of Jurassic, Cretaceous and Tertiary plants they have brought back extensive collections of Upper Cretaceous invertebrates, of Tertiary invertebrates and vertebrates, the latter including the remains of five new genera of birds and a species of *Zeuglodon*.[5]

The paleobotanical materials were turned over to Professor Nathorst, the veteran student of Arctic fossil floras, who published two preliminary announcements, the first in the *Comptes rendus* of the French Academy for June 6, 1904, entitled *Sur la flore fossile des regions antarctiques* and the second before the International Geologic Congress at Mexico City in 1906, entitled "On the Upper Jurassic Flora of Hope Bay, Graham Land."

Pressure of other work entailed his turning over the materials to other specialists for final elaboration and we now have a memoir by Dusén on the Tertiary floras, one by Gothan on the fossil woods, some of which are of Upper Cretaceous age, and a third by Halle on the Mesozoic flora.

The Jurassic flora from Hope Bay is the most extensive of these three floras and in some respects the most interesting.

Halle's memoir of the latter flora[6] is one of the most careful examples of systematic paleobotanical work that has appeared in recent years, maintaining an eminently sane point of view, and occupying middle ground between the pronounced conservatism of the English students of Mesozoic floras and the unduly sanguine work of some of the older paleobotanists, such as Saporta or Heer.

Although the method has been criticized,[7] Halle maintains, quite rightly it seems to me, that it is better to describe new species than

[3] See article in *Geogr. Jour. Lond.*, Vol. 23, February, 1904, by Nordenskiöld and others, giving a general account of the expedition. Reprinted in Smithsonian Report for 1903, pp. 467–479, pl. 1, 1904.

[4] Larsen, *Geogr. Jour.*, Vol. 4, 1894, p. 333.

[5] A summary of the results and a preliminary account of the geology is given by J. Gunnar Andersson, *Bull. Geol. Inst., Upsala*, Band 7, 1906, pp. 19–71, Pl. 1–6.

[6] A brief review by F. H. Knowlton appeared in SCIENCE, Vol. 37, pp. 763–764, May 16, 1913.

[7] Seward, *New Phyt.*, Vol. 12, 1913, p. 188.

to identify doubtful material with previously described forms, especially when widely separated either geologically or geographically, since it is subsequently much easier to reduce a new name to synonymy than to disentangle a complex agglomeration that gets distributed through the literature under a single name.

The Jurassic flora was found in a hard slaty matrix preserving large-sized and clearly outlined specimens, but not showing the venation characters especially well. The collection embraces over sixty forms, of which, however, nearly a score have not been given specific names. The Equisetales are represented by *Equisetites approximatus* sp. nov., a form closely resembling *E. rajmahalensis* Schimper from the Indian Jurassic as well as *E. Duvalii* Saporta. The Hydropterideæ are represented by well-preserved specimens of the wide-spread Jurassic species *Sagenopteris paucifolia* (Phillips) Ward. Fern fronds are abundant, twenty-five different species being represented. These include a *Dictyophyllum;* the wide-ranging Jurassic *Todites Williamsoni* (Brongniart) Seward; seven forms referred to *Cladophlebis,* four being wide-ranging Jurassic forms and two being new. Three fern species are identified with well-known forms of *Coniopteris;* eight are referred to the form-genus *Sphenopteris,* four of these being new; two new species are described in *Scleropteris;* and the doubtful genera *Pachypteris* and *Thinnfeldia* are retained with the ferns. The *Pachypteris* is considered to be identical with *P. dalmatica* F. v. Kerner, a European Cenomanian species. The *Thinnfeldia,* which is described as new and compared with *T. rhomboidalis* Ettings., *T. indica* Feistm., and *T. speciosa* (Ettings.), Seward, is not unlike *T. granulata* Fontaine from the Patuxent formation (Lower Cretaceous) of Virginia.

Fronds of the Cycadales, which are not especially common in the Arctic Jurassic, constitute a prominent element in the Hope Bay flora, some nineteen species being represented. These include a large and abundant entire type of *Nilsonia* which Halle described as a new species. Except for the fact that our east American *Nilsonia densinerve* (Font.) Berry seems to have been rarely entire and the Antarctic form constantly so, there is a similarity, almost amounting to identity, between the two, a fact which Halle has not failed to notice. Three forms are referred to Seward's new genus *Pseudoctenis,* which is close to the American Lower Cretaceous genus *Ctenopsis* Berry. Four new species are instituted in *Zamites* for types of fronds often referred to the genus *Ptilophyllum.* Six forms are referred to *Otozamites* and there is a new species of *Williamsonia,* a form identified as *Ptilophyllum,* and an unnamed species of *Cycadolepis.*

The coniferous remains are abundant and include representatives of fifteen species referred to the genera *Araucarites, Pagiophyllum, Brachyphyllum, Sphenolepidium, Conites, Stachyopitys* and *Elatocladus.* This is the least satisfactory part of the memoir, but as the genera of fossil coniferophyta are in an almost hopelessly tangled state the author can not be blamed for any shortcomings in this respect. The genus *Elatocladus* with four species is proposed as a convenient term for sterile shoots of the radial or dorsiventral type, which are not certainly referrable to established genera with known fruiting characters. Like all form-genera this is confessedly artificial and it may well be doubted if in a world where all generic and specific determinations of recent as well as fossil forms contain a more or less varying personal equation whether it helps to clarify a complex situation.

Forms conspicuously wanting are *Podozamites* and all traces of *Ginkgoales* represented in northern floras by several genera such as *Ginkgo, Baiera, Phœnicopsis, Czekanowskia,* etc. These are also wanting or only doubtfully represented in the fossil floras of India. The abundant *Zamites* and *Otozamites* fronds are also consistently smaller types than in northern floras. There are absolutely no traces of Angiosperms.

Hope Bay is in latitude 63° 15′ S. and it is, therefore, the most southerly point furnishing a flora of Jurassic age.[8] It is, therefore, re-

[8] Members of the Shackleton Expedition collected petrified wood and recorded the occurrence of a coal seam in latitude 80° S.

markable, considering its remoteness, that the flora should show so great a resemblance to that of the English Oolitic flora or the Upper Gondwana flora of India. It contains a number of forms identical with Arctic, Eurasiatic and North American Jurassic plants and adds another link in the chain of facts showing the cosmopolitan character of Jurassic floras. As regards the exact age of the Hope Bay flora Halle concludes that there is no reason to believe that it is in any considerable degree older or younger than other floras known to be of Middle Jurassic age. It seems to me that if anything it is younger, especially if the identification of *Pachypteris dalmatica* is certain. The resemblance of some of the Antarctic forms to American Lower Cretaceous species and the identification of Wealden forms, even if somewhat uncertain, is entitled to the weight which should always be given to new as against surviving types.

Regarding Jurassic climatic conditions the present contribution is of vast importance. Collected in a glaciated region where there are only two existing species of vascular plants, it presents no intrinsic evidence that would have prevented it having come from England, Italy or India. There is no dwindling of the forms or reduction of certain groups as some authors have maintained to be the case in high northern latitudes. This is all the more interesting since the recent discovery of the *Glossopteris* flora in the geographically near Falkland Islands shows that the two floral and climatic provinces of the closing Paleozoic—the northern or cosmopolitan and the *Glossopteris-Gangamopteris* type, found expression in the far south, but in terms of geologic time were of short duration.

All of Snow Hill Island and the larger southwestern part of Seymour Island, as well as a considerable area of the eastern part of Ross Island around Cape Hamilton, which is just across Admiralty Sound from Snow Hill Island, is made up of Upper Cretaceous strata, mostly sandstones. These contain rich faunas of which the ammonites, abounding in individuals and species, have been described by Professor Kilian of Grenoble.[8] The Pelecypoda, Gastropoda and Annelida have been described by Wilckens;[9] the Brachiopoda by Buckman;[10] the Echinoidea by Lambert;[11] the corals by Felix;[12] the Foraminifera by Holland,[13] and the fishes by Smith Woodward.[14] Altogether these contributions add an imposing array of Cretaceous fossils to Antarctica. The faunas indicate an older and a younger Cretaceous series of which the latter is much the richer in both species and individuals. The older is considered to correspond approximately to the Ootator group of India of lower Cenomanian age, while the younger is Senonian and shows considerable resemblance to the fauna of the Quiriquina beds of southern Chile, and to marine beds in southern Patagonia[15] made known by Steinmann and Wilckens.

Impressions of a single Cretaceous plant were found in a Nunatak group near the middle of Snow Hill Island. This has been determined by Professor Nathorst to be close to *Sequoia fastigiata* (Sternb.) Heer, a species of conifer that is not uncommon in the Cenomanian of Europe, occurring also from the Cenomanian upward into the Senonian of Greenland and also present in the Tuscaloosa formation of Alabama. It is described and figured in Halle's memoir on the Jurassic flora.

Some of the petrified woods described by Gotham come from the Upper Cretaceous, but as there is some doubt as to the horizons from which the specimens came the Cretaceous and Tertiary woods may be considered together.

Fossil wood was found on both Seymour

[8] Kilian and Reboul, "Les Céphalopodes Néocrétacés," *Wissen. Ergeb.*, Band 3, Lief 6.

[9] *Ibid.*, Lief 12.

[10] Lief 7.

[11] Lief 11.

[12] Lief 5.

[13] Lief 9.

[14] Lief 4.

[15] Wilckens has proved that the southern Patagonian beds are synchronous with the Rosa and Salamanca beds of central and northern Patagonia and included them all in what he calls the San Jorge formation.

and Snow Hill Islands. Gothan, who has described the fossil woods, has differentiated six forms, all new. Five of these are given specific names and all of the determinable forms are from Seymour Island. They are as follows: *Phyllocladoxylon antarcticum, Podocarpoxylon aparenchymatosum, Dadoxylon (Araucaria) pseudoparenchymatosum, Laurinoxylon uniseriatum, Laurinoxylon?* sp., *Nothofagoxylon scalariforme.* As I have already mentioned, there is, unfortunately, some uncertainty as to their exact age. Part of the specimens representing the *Phyllocladoxylon* are Tertiary and the balance are Upper Cretaceous or Tertiary. The *Podocarpoxylon* is given as Tertiary and the balance may be either Upper Cretaceous or Tertiary. In either case they show that types now regarded as South American or Australasian were much more wide-spread in the early Tertiary or late Cretaceous. It is of some interest to find structural remains of Araucarieæ, Lauraceæ and *Nothofagus,* since these three types are also represented in the leaf impressions studied by Dusén.

The northeastern portion of Seymour Island is made up of Tertiary beds. These are mostly marine calcareous sandstones, but with some tuffs containing augite-porphyrite. In these sandstones Nordenskiöld discovered leaf impressions which Nathorst reported upon in his brief paper of 1904.[16] They have been monographed by Dusén.[17] The material is abundant but very fragmentary. Dusén recognizes 87 different forms, of which only 25 receive specific names. Both the results and their method of presentation are open to criticism. While Dusén has brought to the work an extensive acquaintance with the existing flora of South America, it does not appear that he has an equal knowledge of paleobotanical literature and there is a tendency to see an undue resemblance to the existing flora he seems to know best.

There are 26 different *Phyllites* sp., some of which are Angiosperms and some Gymnosperms. Of the 37 different ferns only nine are identified and we are treated to the abominable array of 10 *Sphænopteris* sp. and 18 *Pecopteris* sp., both form-genera that should really be reserved for Paleozoic fern-like remains, *Sphenopteris* being partly, and presumably wholly, Pteridospermic and *Pecopteris* being filicalean. With the exception of a *Fagus* previously described by Dusén from the Straits of Magellan and a *Nothofagus* described by Engelhardt from the same region, all of the named species are new to science. They include forms in the following genera: *Miconiiphyllum, Lauriphyllum, Mollinedia, Araucaria, Polypodium, Asplenium, Alsophila, Dryopteris, Caldcluvia, Laurelia, Drimys, Lomatia, Knightia, Fagus, Nothofagus* and *Myrica.*

The first eight of these have their closest affinities with forms in the existing subtropical flora of southern Brazil, while the balance resemble existing species of West Patagonia and southern Chili. Dusén concludes that this mixed character is due to differences in altitude at which the Seymour Island plants grew. This may well be the case, but on the other hand the author is apparently unaware of the polar extension of more equatorial climates with a mixing of types since associated with temperate or tropical conditions that occurs in the early Tertiary, or to the general lack of well-defined climatic zones in the history of the earth throughout geological times. Many attempts have been made to emphasize the fact that climates like that of the present or the Pleistocene, of which the present is really a part, or of *Glossopteris* time, or of earlier glacial periods, were the exception and not the rule when all geological time is considered. The consequent lack of extreme cold in the Tertiary when accompanied by sufficiently humid conditions would answer for the Seymour Island Tertiary flora equally as well as an altitudinal zonation.

According to Dusén this flora is typically South American, with only slight relationships to the flora of New Zealand (cf. *Laurelia*) and Australia (cf. *Knightia*). This is perhaps what would be expected since both tectonically and petrographically Graham Land

[16] *Comptes rendus, loc. cit.*

[17] Lief 3, 1908.

seems to represent a southward extension of the Andean axis. At the same time, it seems to me that a more critical analysis of the flora by a student qualified to compare it with the living and fossil floras of Australia, New Zealand and with more northern Tertiary floras, would bring out a good many significant features that remain hidden in Dusén's work.

Regarding the age of the Seymour Island Tertiary, Dusén, relying on comparisons with the fossil floras from the Straits of Magellan and Chili and on the affinities of the associated Mollusca, as communicated by Wilckens, concludes that it is late Oligocene or early Miocene. I would be much more inclined to consider its age as somewhat older and corresponding roughly to that of the Arctic Tertiary floras, which in turn are contemporaneous or slightly younger than those in lower latitudes that are marked by that northward extension of tropical climates which commences in the early Eocene and culminates in this country in the Vicksburg and Apalachicola groups.

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SCIENTIFIC NOTES AND NEWS

SIR WILLIAM OSLER has accepted an invitation to deliver the principal address at the opening of the James Buchanan Brady Urological Clinic of the Johns Hopkins Hospital.

THE annual Huxley Memorial Lecture of the Royal Anthropological Institute will be delivered on November 14, by Professor W. J. Sollas, F.R.S., who will take as his subject "Paviland Cave."

THE council of the Royal Meteorological Society has awarded the Symons gold medal to Mr. W. H. Dines, F.R.S. The medal will be presented at the annual meeting of the society on January 21.

THE Baly medal of the Royal College of Physicians of London has been presented to Dr. John Scott Haldane, F.R.S., reader in physiology in the University of Oxford. The medal was founded by Dr. Frederic Daniel Dyster in 1866 in memory of William Harvey, and is awarded every alternate year. The last five recipients have been Professor J. N. Langley, F.R.S. (1903), Professor Pawlow, of St. Petersburg (1905), Professor E. H. Starling, F.R.S. (1907), Professor Emil Fischer, of Berlin (1909), and Professor W. D. Halliburton, F.R.S. (1911).

ON the recommendation of the committee on the award of the Hodgkins prize of $1,500 for the best treatise "On the Relation of Atmospheric Air to Tuberculosis," which was offered by the Smithsonian Institution in connection with the International Congress on Tuberculosis held in Washington in 1908, the institution announces that the prize has been equally divided between Dr. Guy Hinsdale, of Hot Springs, Virginia, for his paper on "Tuberculosis in Relation to Atmospheric Air," and Dr. S. Adolphus Knopf, of New York City, for his treatise on the "Relation of Atmospheric Air to Tuberculosis." The members of the committee on award were: Dr. William H. Welch, John Hopkins University, Baltimore, Md., *chairman;* Dr. Hermann M. Biggs, New York City; Professor W. M. Davis, Cambridge, Mass.; Dr. G. Dock, Washington University Medical School, St. Louis, Mo.; Dr. Simon Flexner, Rockefeller Institute for Medical Research, New York City; Dr. John S. Fulton, Baltimore, Md., and Brig. Gen. George M. Sternberg, U. S. A. (retired), Washington, D. C.

PROFESSOR R. BURTON-OPITZ, of the College of Physicians and Surgeons, Columbia University, has been elected president of Alpha Omega Alpha, the honorary medical society, which now has chapters in the seventeen most representative medical colleges.

MR. H. N. BAKER, assistant superintendent of the National Zoological Park at Washington, has resigned to become superintendent of the Boston Zoological Garden.

DR. ROBERT MATHESON, formerly provincial entomologist of the Province of Nova Scotia, has recently resigned to accept the position of investigator in entomology in Cornell Agricultural Experiment Station, Ithaca, N. Y.